

Cardaria draba (L.) Desv. (Brassicaceae)
Hoary Cress

Description. Perennial herbs, from deep, extensive, well-developed rhizomes. Stems 15-90 cm tall, erect to decumbent, glabrous, sometimes pubescent below. Leaves 3-10 cm long, basal and lower leaves obovate to oblong, tapered to a short petiole; middle and upper leaves sessile, often clasping, elliptic to oblong or lanceolate; margins of all leaves entire to remotely toothed. Inflorescence a corymbose panicle; petals 2.5-4 mm long, white; pedicels in fruit 6-15 mm long, ascending to spreading. Fruit a silicle, 2-4.5 mm long, 3-5 mm wide, inflated, cordate or reniform in outline, often slightly constricted along the septum, glabrous. Seeds 1-2 per locule, ca. 1 mm wide, ovoid (Abrams 1944, Ball 1964, Fernald 1950, Barker 1986, Munz 1959, Rollins 1993).

Note: The closely related *C. chalepensis* (L.) Hand.-Mazz. differs by having fruits ovate to obovate in outline, with no constrictions along the septum. Otherwise, the two species are very similar with respect to life form, ecological distribution, and weediness. *Cardaria* is apparently closely related to *Lepidium* and, in the broad sense, may be considered derived from within the latter genus (Mummenhoff 1995).

Geographic distribution. Native of southern Europe (Ball 1964), but now widely distributed throughout Europe (Dorofeev 1996). Introduced into southern Africa, Saudi Arabia, Australia, New Zealand, western North America, especially in Canada and the western United States (Arnold and De Wet 1993, El-Karemy and Zayed 1996, Hewson 1982, Rollins 1993, Webb et al. 1988).

Hoary cress was first reported from California ("Yreka") in 1876 (Brewer et al. 1876, Robbins 1940). Naturalized populations occur on Santa Catalina and Santa Cruz islands (Junak et al. 1997), coastal California from Del Norte County southward to San Diego County, and in most counties west of the Sierra Nevada (Anonymous 1998, Rollins 1993).

Ecological distribution. In natural habitats *Cardaria* occurs in fields and disturbed areas along roadsides. In its naturalized geographic range, it occurs in fallow and cultivated fields, ditches, pasture, roadsides. Although it can occur on a wide range of substrates, it is most abundant on irrigated saline soils (El-Karemy and Zayed 1996, Hewson 1982, Lorenzi and Jeffery 1987, Munz 1959, Robbins et al. 1970, Rollins 1993).

Reproductive and vegetative biology. Like its close relatives (*Cardaria pubescens* and *Lepidium latifolium*), hoary cress is probably self-compatible and largely autogamous (Rollins 1993). Hoary cress has been extremely difficult to control when present in large infestations. Based on studies of growth and resource allocation, Miller et al. (1994) suggest that failure of eradication attempts results from several factors, including the presence of an extensive underground rhizome system, a short period of maximum allocation to belowground tissue, and the wide variation of phenology among plants at any given time. Young et al. (1996) reported that perennial pepperweed (*Lepidium latifolium* L.) was similar in its reproductive biology and invasiveness, and that the same control methods could be used.

Weed status. *Cardaria draba* is not considered a noxious weed in agricultural or horticultural practice, at least at a global level (not listed by Holm et al. 1977), nor is it considered a noxious weed by the State Dept. of Food and Agriculture (Anonymous 1996). However, Lorenzi and Jeffery (1987) consider it a noxious weed in most of the United States. Hoary cress has also been considered a serious pest in Australia, New Zealand, and the Pacific northwest (Hewson 1982, Webb et al. 1988).

Microbial pathogens. No literature was found pertaining to fungal pathogens. Miller et al. (1994) reported that no fungal pathogens have been identified as occurring on hoary cress.

Nematode and insect pathogens. Eriophyid mites, because of strong host specificity, may be effective in reducing infestations of hoary cress (Craemer et al. 1996, Rosenthal 1997). No literature was found pertaining to insect pathogens. Young et al. (1995) reported that no effective biological controls of members of the mustard family were known.

Herbicide control. Glyphosate has been recommended in croplands during early stages of flowering and a combination of 2,4-D and dicamba or picloram in pastures, and amitrole in waste areas or abandoned fields (Lorenzi and Jeffery 1987). Young et al. (1996) report effective use of 2,4-d and chlorsulfuron in controlling the related perennial pepperweed. Herbicide treatments were enhanced by mechanical methods, including mowing.

Literature Cited

- Abrams, L. 1944. Illustrated flora of the Pacific states. Volume 2. Polygonaceae to Krameriaceae. Stanford University Press, Stanford, California. 635 pp.
- Anonymous. 1996. Exotic pest plants of greatest ecological concern in California as of August 1996. California Exotic Pest Plant Council. 8 pp.
- Anonymous. 1998. USDA Plants Database. USDA National Plants Data Center, New Orleans, Louisiana. URL: plants.usda.gov
- Arnold, T. and B. de Wet. 1993. Memoir 62. Plants of southern Africa: names and distribution. National Botanical Institute, Pretoria. 825 pp.
- Ball, P. 1964. *Cardaria*. p. 333. In Tutin et al. (eds.) Flora Europaea. Volume 1. Lycopodiaceae to Platanaceae. Cambridge University Press, Cambridge. 464 pp.
- Barker, W. 1986. Brassicaceae. pp. 293-333. In Great Plains Flora Association. 1986. Flora of the Great Plains. University Press of Kansas, Lawrence. 1392 pp.
- Brewer, W., S. Watson, and A. Gray. 1876. Geological Survey of California. Volume 1. John Wilson, University Press, Cambridge, Massachusetts. 622 pp.
- Craemer, C., S. Neser, and M. Smith-Meyer. 1997. Eriophyid mites (Acari: Eriophyoidea: Eriophyidae) as possible control agents of undesirable introduced plants in South Africa. Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie. 1: 99-109.
- Dorofeev, V. 1996. Genus *Cardaria* (Brassicaceae) in the Caucasus flora. Botanicheskii Zhurnal 81: 93-95.
- El-Karemy, Z. and K. Zayed. 1996. A contribution to the vegetation and habitat types of Baha plateau (Saudi Arabia). Feddes Repertorium 107: 135-144.

- Fernald, M. 1950. Gray's Manual of Botany. Eighth Edition. American Book Company, New York. 1632 pp.
- Gleason, H. and A. Cronquist. 1991. Manual of the vascular plants of northeastern United States and adjacent Canada. Second edition. New York Botanic Garden, Bronx. 910 pp.
- Hewson, H. 1982. Brassicaceae. pp. 231-357. In George et al. (eds.). Flora of Australia. Volume 8. Lecythidales to Batales. Australian Government Printing Service, Canberra. 420 pp.
- Junak, S., S. Chaney, R. Philbrick, and R. Clark. 1997. A checklist of vascular plants of Channel Islands National Park. Southwest Parks and Monuments Association, Tucson, AZ. 43 pp.
- Lorenzi, H. and L. Jeffery. 1987. Weeds of the United States and their control. Van Nostrand Company, New York. 355 pp.
- Miller, R., T. Svejcar, J. Rose, and M. McInnis. 1994. Plant development, water relations, and carbon allocation of heart-podded hoary cress. Agronomy Journal. 86: 487-491.
- Mummenhoff, K. 1995. Should *Cardaria draba* (L.) Desv. be classified within the genus *Lepidium* L. (Brassicaceae)? Evidence from subunit polypeptide composition of RUBISCO. Feddes Repertorium. 106: 25-28.
- Munz, P. 1959. A flora of California. University of California Press, Berkeley. 1681 pp.
- Robbins, W. 1940. Alien plants growing without cultivation in California. Agricultural Experiment Station Bulletin 637. University of California, Berkeley. 128 pp.
- Robbins, W. M. Bellue, and W. Ball. 1970. Weeds of California. Department of Agriculture, Sacramento, California. 547 pp.
- Rollins, R. 1993. The Cruciferae of North America. Stanford University Press, Stanford, California. 976 pp.
- Rosenthal, S. 1996. Biological control of weeds: *Aceria*, *Epitrimerus* and *Aculus* species and biological control of weeds. pp. 729-739. In Lindquist, E., M. Sabelis and J. Bruin (Ed.). World Crop Pests. Vol. 6. Eriophyoid mites: Their biology, natural enemies and control. Elsevier Science Publishers, New York, New York. 790 pp.
- Young, J., D. Palmquist, R. Blank, and C. Turner. 1996. Ecology and control of perennial pepperweed (*Lepidium latifolium* L.). pp. 29-31. In J. Lovich, J. Randall, and M. Kelly (eds.) Proceedings, California Exotic Pest Plant Council Symposium. California Exotic Pest Plant Council. Sacramento, CA. 64 pp.
- Webb, C., W. Sykes, and P. Garnock-Jones. 1988. Flora of New Zealand. Volume 4. Naturalized pteridophytes, gymnosperms, dicotyledons. Department of Scientific and Industrial Research, Christchurch. 1365 pp.